

What Is Claimed Is:

1. A system for monitoring a complex process  
over a transition phase from a first mode, said system  
5 comprising:

a database containing identifying data related to  
known modes and known transitions;

a measurement device providing current process  
data related to said complex process;

a comparator using said identifying data and said  
current process data so as to determine which one of  
said known modes and said known transitions that said  
complex process is currently within; and

15 a range checking component using stored data of  
said one of said known modes and said known  
transitions as determined by said comparator, and  
using said current process as data so as to signal  
when said complex process is outside of an acceptable  
range.

2. A system according to claim 1 wherein said transition phase includes at least one changing process variable.

5 3. A system according to claim 1 wherein said mode includes all substantially constant variables.

4. A system according to claim 1 wherein said complex process comprises a second mode after said transition phase.

5. A system according to claim 1 wherein said identifying data related to said known modes and said known transitions is based on historical data.

15 6. A system according to claim 1 wherein said identifying data related to said known transitions are based on theoretical data.

20 7. A system according to claim 1 wherein said comparator is configurable to receive input from an

operator to determine whether said complex process is currently within one of said known modes and said known transitions.

5        8. A system according to claim 1 wherein each of said known modes and said known transitions is subdivided into enhanced states, and further wherein said database contains identifying data related to each of said enhanced states of said known modes and said known transitions so as to determine which one of said enhanced states of said known modes and said known transitions that said complex process is currently within.

15        9. A system according to claim 8 wherein each of said enhanced states is subdivided into atoms, and further wherein said database contains identifying data related to each of said atoms of said enhanced states of said known modes and said known transitions so as to determine which one of said atoms of said enhanced states of said known modes and said known

transitions that said complex process is currently  
within.

10. A system according to claim 1 wherein said  
5 identifying data of said comparator comprises mapped  
data.

11. A system according to claim 10 wherein at  
least a portion of said mapped data relates to said  
known transitions.

12. A system according to claim 10 wherein at  
least a portion of said mapped data relates to known  
modes.

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13. A system according to claim 10 wherein at  
least a portion of said mapped data relates to an  
individual subsection of said known transitions.

14. A system according to claim 10 wherein at least a portion of said mapped data relates to an individual subsection of said known modes.

5 15. A method for monitoring a complex process over a transition phase from a first mode, said method comprising:

providing a database containing identifying data related to known modes and known transitions;

obtaining current process data related to said complex process;

comparing said current process data with said identifying data so as to determine which one of said known modes and said known transitions that said complex process is currently within; and

15 20 comparing said current data with stored data of said one of said known modes and said known transitions as determined by said comparator so as to signal when said complex process is outside of an acceptable range.

16. A method for supervising a complex process involving a client, said method comprising:

5 identifying a state of said complex process, said state comprising one of at least one transition phase and at least one mode;

reporting said identified state comprising said one of at least one transition phase and at least one mode to said client; and

10 reconfiguring said client based on said identified state of state of said complex process.

15 17. A method for classifying a complex process into modes and transition phases, said method comprising:

17 identifying values of given variables within a subsection of said complex process;

20 determining the magnitude of variation of each of said values of said given variables over said subsection of said complex process; and

25 classifying said subsection into one of said modes and said transition phases based on said

magnitude of variation of each of said values of said given variables over said subsection of said complex process.

18. A method according to claim 17 wherein a section is classified in a mode when each of its subsections are classified in modes.

19. A method according to claim 17 wherein a section is classified in a transition when at least one of its subsections is classified in a transition phase.

20. A method of generating knowledge base for monitoring a complex process over a transition, said method comprising:

obtaining plant history data and plant hierarchy;  
grouping plant tags into sections and  
subsections;

generating a process trend and a wavelet coefficient for each said plant tags;

generating process trends for each tag in every  
lower-level group;

identifying periods of constancy for each  
variable in each lower-level group using said  
5 generated process trends;

identifying modes for each lower-level group;  
consolidating and characterizing modes for each  
lower-level group;

consolidating and characterizing transitions;  
generating an event list for each lower-level  
group;

generating an event lookup table for higher-level  
groups; and

generating said knowledge base.

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21. A method for identifying a state of a  
complex process, said state comprising one of at least  
one transition phase and at least one mode, said  
method comprising:

20 providing tagged sensor data from said complex  
process;

segregating said tagged sensor data into plant sections and subsections of a plant hierarchy using a knowledge base;

5 analyzing the range of variables of each of said subsections using said knowledge base so as to determine which one of a transition phase with at least one of said variables outside of said pre-determined range and a mode with all of said variables within said pre-determined phase that said subsection is currently within;

10 identifying a current mode for each of said subsections in one of said modes based on values of said variables and said knowledge base;

15 identifying current transition phases for each of said subsections in one of said transition phases using wavelet-based feature comparison for key variables with said knowledge base; and

20 deducing events in higher level plant groups using each of said current modes, current transitions, and said knowledge base.

22. A method for identifying a current transition phase of a complex process, said method comprising:

5 generating wavelet approximation coefficients for variables in a subsection in said current transition phase;

10 comparing said wavelet approximation coefficients of said current transition phase with corresponding wavelet coefficients for transitions available in a knowledge base; and

15 identifying said current transition phase based on said comparison of said wavelet approximation coefficients of said current transition phase with said corresponding wavelet coefficient for transitions available in said knowledge base.

23. A method to track a complex process within transition phase, said method comprising:

20 providing distinct features of process variables of common operation data within a common transition phase;

measuring distinct features of process variables  
of said complex process within said transition phase;  
and

5 comparing said distinct features of said process  
variables of said complex process within said  
transition phase and said distinct features of said  
process variables of said common operation data within  
said common transition phase so as to track said  
complex process.

10 24. A method for determining an enhanced trend  
for a series of one subset of distinct features of a  
process variable, said method comprising:

15 obtaining stored information related to said  
series of said one subset of said distinct features of  
said process variable;

20 obtaining current information related to said one  
subset of said distinct features of said process  
variable; and

25 comparing said current information related to  
said one subset of said distinct features of said

process variable and said stored information related  
to said series of said one subset of said distinct  
features of said process variable to one another so as  
to determine said enhanced trend for said series of  
5 said one subset of distinct features of said process  
variable.

25. A method for tracking a trend of a process  
variable against a stored trend as given in a  
10 dictionary, said method comprising:

comparing said trend of said process variable to  
a current dictionary atom and a subsequent dictionary  
atom;

15 identifying one of said current dictionary atom  
and said subsequent dictionary atom corresponding to  
said trend of said process variable; and

broadcasting information related to current  
transition phase of said identified current dictionary  
atom to sections of a plant.

26. A method for monitoring a complex process  
during a transition phase, said method comprising:  
    measuring a real-time enhanced trend of process  
variables;  
5      identifying a dictionary enhanced trend of said  
process variables;  
    comparing trends of each of said real-time  
enhanced trend and said dictionary enhanced trend to  
one another;  
10      comparing process variable magnitudes of each of  
said real-time enhanced trend of said process  
variables and said dictionary enhanced trend to one  
another;  
    comparing trend durations of each of said real-  
time enhanced trend of said process variables and said  
15      dictionary enhanced trend to one another;  
    calculating a matching degree for each of said  
process variables from said trend comparison, said  
process variable magnitude comparison, and said trend  
20      duration comparison;

calculating a degree of fault of said complex process as a function of degree of fault of individual sensors; and

informing an operator of said matching degree and  
5 said degree of fault.

27. A system according to claim 1 wherein said identifying data related to said known transitions are based on experience-based data.

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